AMENDMENT

Amendment to the claims:

Please amend claims 54, 57-59, 64, 66, 71, 83-86, 90, 92-94, 98, and 107-118 and add new claims 119-134 to read as follows:

(A set of the amended claims is set in Appendix A (marked up) and a complete set of pending claims is set in Appendix B (clean)).

54. (Twice Amended) An apparatus comprising:

a) a sample introduction zone;

b) at least one peptide nucleic acid probe associated with a particle; and

c) an electrophoretic separation channel in communication with said introduction zone;

wherein the peptide nucleic acid probe is disposed within the apparatus and is mobilizable at least within the separation channel.

57. (Twice Amended) An apparatus comprising:

a) a sample introduction zone;

b) an electrophoretic separation channel in communication with said introduction zone;

c) at least one peptide nucleic acid probe labeled with a detectable moiety, said peptide nucleic acid probe disposed within the apparatus upstream of said separation channel and being mobilizable at least within the separation channel; and

d) a sample incubation zone disposed in communication with the sample introduction zone and in communication with the separation channel.

58. (Twice Amended) A microchip apparatus comprising a plurality of capillary channels, each said capillary channel further comprising:

a) a sample introduction zone;

b) an electrophoretic separation zone in communication with said introduction zone;

c) at least one peptide nucleic acid probe labeled with a detectable moiety, said peptide nucleic acid probe being mobilizable at least within the separation zone and disposed within the apparatus to mix upstream of the separation zone with a sample introduced in each said introduction zone, said sample comprising at least one double stranded polynucleotide, said at least one peptide nucleic acid probe having a sequence complementary to a selected target sequence suspected to be present in said at least one double stranded polynucleotide;

d) a nucleic acid/nucleic acid denaturing reagent permitting the formation of a peptide nucleic acid probe/nucleic acid complex when said selected target sequence is present;

e) a detection zone; and

f) said separation zone in communication with said introduction zone and said detection zone.

C4 59. (Amended) The microchip apparatus of claim 58 wherein the separation zone of at least one of said capillary channel comprises an electrophoretic sieving medium.

C5 64. (Twice Amended) The microchip apparatus of claim 58 wherein at least one of said at least one peptide nucleic acid probe comprises a charge-modifying moiety.

C6 66. (Twice Amended) The microchip apparatus of claim 58 wherein said at least one peptide nucleic acid probe is associated with a particle.

71. (Amended) A microchip apparatus comprising a plurality of capillary channels, wherein each of said capillary channels further comprises:

a) a sample introduction zone;

b) an electrophoretic separation zone in communication with said introduction zone;

c) at least one peptide nucleic acid probe labeled with a detectable moiety, said peptide nucleic acid probe disposed within the apparatus upstream of the separation zone and being mobilizable at least within the separation zone; and

d) a detection zone; wherein said separation zone is in communication with said introduction zone and said detection zone.

83. (Amended) The microchip apparatus of claim 58 wherein the peptide nucleic acid probe is modified with the detectable moiety.

84. (Amended) The microchip apparatus of claim 58 wherein the detectable moiety is bound to the peptide nucleic acid probe.

85. (Amended) The microchip apparatus of claim 58 wherein the detectable moiety is associated to the peptide nucleic acid probe.

86. (Amended) The apparatus of claim 54 wherein the separation channel comprises an electrophoretic sieving medium.

90. (Amended) The apparatus of claim 54 wherein said at least one peptide nucleic acid probe further comprises a charge-modifying moiety.

92. (Amended) The apparatus of claim 54 further comprising a sample incubation zone disposed in communication with said sample introduction zone and said separation channel.

93. (Amended) The apparatus of claim 54 further comprising a sample detection zone disposed in communication with said separation channel.

94. (Amended) The apparatus of claim 57 wherein the separation channel comprises an electrophoretic sieving medium.

98. (Amended) The apparatus of claim 57 wherein said at least one peptide nucleic acid probe comprises a charge-modifying moiety.

107. (Amended) The apparatus of claim 57 wherein the peptide nucleic acid probe is modified with the detectable moiety.

108. (Amended) The apparatus of claim 57 wherein the detectable moiety is bound to the peptide nucleic acid probe.

109. (Amended) The apparatus of claim 57 wherein the detectable moiety is associated to the peptide nucleic acid probe.

110. The apparatus of claim 57 further comprising a sample detection zone disposed in communication with said separation channel.

111. (Amended) The microchip apparatus of claim 71 wherein the detectable moiety is bound to the peptide nucleic acid probe.

112. (Amended) The microchip apparatus of claim 71 wherein the peptide nucleic acid probe is bound to biotin.

113. (Amended) The microchip apparatus of claim 71 wherein the peptide nucleic acid probe is bound to fluorescein.

114. (Amended) The microchip apparatus of claim 71 wherein the peptide nucleic acid probe is modified with the detectable moiety.

115. (Amended) An apparatus comprising:

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a. a sample introduction zone;

b. an electrophoretic separation channel in communication with said introduction zone;

c. at least one peptide nucleic acid probe modified with a label, said label comprising a detectable moiety, said peptide nucleic acid probe disposed within said apparatus upstream of said separation channel and being mobilizable at least within the separation channel; and

d. a sample incubation zone disposed in communication with the sample introduction zone and in communication with the separation channel.

116. (Amended) The apparatus of claim 115 wherein the detectable moiety is bound to the peptide nucleic acid probe.

117. (Amended) The apparatus of claim 115 wherein the peptide nucleic acid probe is bound to biotin.

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118. (Amended) The apparatus of claim 115 wherein the peptide nucleic acid probe is bound to fluorescein.

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119. (New) A method for separating DNA-containing samples, comprising:

(a) providing a sample-separation device including an injection channel and an electroseparation channel, with said injection channel being disposed for fluid communication with said electroseparation channel;

(b) placing an electrophoretic medium in said electroseparation channel;

(c) mixing (i) a peptide nucleic acid (PNA) probe labeled with a detectable moiety and a (ii) double-stranded-DNA-containing sample under conditions permitting PNA-DNA hybrids to form, but disfavoring DNA-DNA hybrids;

(d) introducing the mixture from step (c) into said injection channel;

(e) applying an electrical potential along at least one of said channels sufficient to cause PNA-DNA hybrids to migrate into and along said separation channel; and

(f) detecting for said detectable moiety.

120. (New) The method of claim 119, wherein said injection and electroseparation channels intersect one another.

121. (New) The method of claim 120, wherein said sample-separation device further comprises a reservoir, with said reservoir being disposed for fluid communication with said injection channel.

122. (New) The method of claim 121, wherein said injection channel, said electroseparation channel, and said reservoir are formed in a microchip.

123. (New) A method for separating samples, comprising:

(a) providing an electroseparation channel;

(b) placing an electrophoretic medium in said electroseparation channel;

(c) mixing (i) a sample comprised of target DNA strands and DNA strands complementary to said target DNA strands, and (ii) a peptide nucleic acid (PNA) probe labeled with a detectable moiety, said PNA probe having a sequence complementary to at least a portion of said target DNA strands, whereby PNA-DNA hybrids are formed;

(d) introducing said PNA-DNA hybrids into said electroseparation channel;

(e) applying an electrical potential along said electroseparation channel sufficient to cause PNA-DNA hybrids to migrate along said electroseparation channel; and

(f) detecting for said PNA-DNA hybrids.

124. (New) The method of claim 123, wherein said mixing is carried out under denaturing conditions, disfavoring DNA-DNA hybrids.

125. (New) A method for separating samples, comprising:

(a) providing a sample comprised of double-stranded DNA;

(b) denaturing said double-stranded DNA to form single-stranded DNA comprising target DNA strands and DNA strands complementary to said target DNA strands;

(c) incubating the target DNA strands and DNA strands complementary to the target DNA strands with a a peptide nucleic acid (PNA) probe labeled with a detectable moiety, said

PNA probe having a sequence complementary to at least a portion of said target DNA strands, whereby DNA-PNA hybrids are formed;

(d) electrophoresing said DNA-PNA hybrids; and

(e) detecting for said PNA-DNA hybrids.

126. (New) The method of claim 125, wherein at least step (d) is carried out on a microchip.

127. (New) A method for separating DNA-containing samples, comprising:

(a) providing a microchip comprised of (i) a substrate; (ii) an injection channel formed in said substrate; (iii) an electroseparation channel formed in said substrate, and disposed for fluid communication with said injection channel, and (iv) a loading reservoir formed in said substrate, and disposed for fluid communication with said injection channel;

(b) placing an electrophoretic medium in said electroseparation channel;

(c) placing in said reservoir (i) a DNA-containing sample including a target DNA sequence, and (ii) a peptide nucleic acid (PNA) probe labeled with a detectable moiety, said PNA probe having a sequence complementary to at least a portion of said target sequence, whereby PNA-DNA hybrids are formed;

(d) applying one or more electrical potentials along said channels sufficient to cause PNA-DNA hybrids to migrate into and along said electroseparation channel; and

(e) detecting for the PNA-DNA hybrids.

128. (New) The method of claim 127, wherein said injection and electroseparation channels intersect one another.

129. (New) A kit for the separation of the components of a mixed sample solution of single stranded nucleic acids and their complementary strands, and for detecting therein a selected target sequence, including:

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(a) a microchip comprised of a substrate and an electroseparation channel formed in said substrate; and

(b) a peptide nucleic acid (PNA) probe labeled with a detectable moiety, said PNA probe having a sequence complementary to at least a portion of said target sequence.